

Evaluation of Screening for Disease

With the increasing emphasis on chronic disease programs in health departments and voluntary agencies, continuation and expansion of screening activities are to be expected. The practical application of screening tests requires a basic knowledge of the attributes of these tests and an understanding of the results that may be expected when a particular test is applied to a population group at a selected screening level.

Screening tests are used to separate those persons with a high probability of having the disease sought from a group of apparently well persons so that they may be given a diagnostic evaluation. Screening tests should be simple to perform, inexpensive, and should be sensitive, specific, and precise.

Sensitivity is the ability of the test to give a positive finding when applied to diseased persons. Specificity is the ability of the test to give a negative finding when applied to persons free of disease. Precision is the ability of the test to give consistent results in repeated trials.

Many aspects of the sensitivity and specificity of screening tests are explained by the theory of overlapping distributions. According to this theory, the screened population consists

of a diseased group and of a nondiseased group, both possessing the characteristic measured by the test with differing frequencies at various intensities. For some test values, both the diseased and nondiseased populations possess the test characteristic, and the diseased and nondiseased groups cannot be distinguished on the basis of the test alone.

The sensitivity-specificity pattern of a test is determined by the shape and degree of overlap of the test value distributions of the diseased and nondiseased populations. Within this pattern, sensitivity and specificity may be varied by changing the level at which the test is considered positive.

The stability of the sensitivity-specificity pattern depends on the stability of the test value distributions from area to area and from time to time. Any change in the shape of either distribution or the degree of overlap will result in a change in the sensitivity-specificity pattern. A change in the prevalence of the disease will result in a change in the sensitivity-specificity pattern only if it affects the overlap or shapes of the test value distributions.

With a knowledge of the sensitivity and specificity of a test and an estimate of prevalence

Public Health Monograph No. 67

Principles and Procedures in the Evaluation of Screening for Disease. By Robert M. Thorner and Quentin R. Remein. Public Health Monograph No. 67 (PHS Pub. No. 846), 23 pages. U.S. Government Printing Office, Washington, D.C., 1961, 25 cents.

The accompanying summary covers the principal contents of Public Health Monograph No. 67, published concurrently with this issue of *Public Health Reports*. Mr. Thorner is chief of operational methods in the Health Services for Long-Term Ill-

ness Branch, and Mr. Remein is assistant chief of the Technical Development Branch, Division of Chronic Diseases, Public Health Service.

For readers wishing the data in full, copies are on sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Official agencies and others directly concerned may obtain single sample copies without charge from the Public Inquiries Branch, Office of Information, Public Health Service. Copies will be found also in the libraries of professional schools and the major universities and in selected public libraries.

and the number of persons to be tested, the results of a testing program in terms of true and false positives and true and false negatives may be assessed. The effect of changing the screening level considered positive and of reaching a higher prevalence group may also be examined.

Several screening tests may be used in a series or parallel arrangement. When used in parallel, a person is considered positive when positive to any one test and negative if negative to all. In series, a screenee must be positive to all tests to be considered positive and is considered negative if negative to any one test.

Using tests in series will result in an increase in specificity but a decrease in sensitivity; conversely, using tests in parallel will increase sensitivity but decrease specificity.

The sensitivity and specificity of a test may be compared against an arbitrarily set standard by simple statistical techniques. In comparing the results of two test techniques two statistical models are necessary, one for tests applied to different populations and one for tests applied to the same population.

The precision of a test may be measured by obtaining paired measurements on the same person and applying a simple formula for the pooled standard deviation of the paired measurements. The measure thus obtained includes variability due to the tester's technique as well as the test itself. The resulting measure may be used to control the quality of the output of a laboratory or testing station. The F test may be used to assess statistical significance of the difference between precision measurements.

Usefulness of Stroke Pamphlet

"Strike Back at Stroke," a Public Health Service publication designed to simplify the physician's task of giving instructions for restorative exercises for stroke victims, has been the subject of an evaluation study by the Kentucky State Health Department. Eighty-eight physicians were randomly selected, presented with the pamphlet, and interviewed 4 months later. Of the 88, 42 had treated patients with stroke or similar conditions in the 4-month period. Of these, 29 had used the pamphlet with a total of 88 patients.

Twenty-five physicians who used the pamphlet said their patients had progressed toward self-care during the time it was used. Sixteen said they had to spend less time with patients because the pamphlet helped patients and families understand what they should do. Some commented that the pamphlet gave the patient and his family something tangible and positive to work with and thereby stimulated a feeling of optimism.

A majority of the physicians interviewed thought that it would be desirable to have similar pamphlets facilitating instruction for care of patients with other manageable conditions.

Federal Publications

Some Facts About Suicide, Causes and Prevention. *PHS Publication No. 852 (Health Information Series No. 101) revised 1961; 11 pages; 10 cents.* Offers advice on causes and prevention of suicide to families and professional people who are in a position to give emergency assistance to the suicidal person. Describes erroneous beliefs about suicide, clues to suicidal intent, and four main types of suicide crises.

Public Health Service Film Catalog. *PHS Publication No. 776; 69 pages; 45 cents.* Annual revision of list of films available from the film library, Communicable Disease Center, Public Health Service.

Noise and Hearing. Relationship of industrial noise to hearing acuity in a controlled population. *PHS Publication No. 850; 1961; 72 pages; 70 cents.*

Relation of changes in hearing acuity to long-term exposure to industrial noise is reported in a study obtained from periodic hearing tests performed on workers in a number of plants of Federal Prison Industries. These tests, made during the period 1953-59, were correlated with noise measurements made in factories.

The findings of these studies should be valuable in establishing standards for conditions under which men can be employed for their entire working lifetime without hearing impairment due to excessive noise. In addition, 12,000 hearing tests given at the time of admission have provided useful information on the relationship of age to hearing.

Hill-Burton Program. Progress report. *PHS Publication No. 880; 1961; 76 pages.*

This annual report summarizes progress under the Hospital and Medical Facilities Construction (Hill-Burton) Program since its beginning in 1946. The program involves Federal grants to assist in the construction of public and voluntary

nonprofit hospitals and related facilities.

The progress report includes highlights of the program, annual Hill-Burton appropriations, summary data on projects, facilities provided, costs, obligated funds, and status of construction. Appendix tables present detailed State data.

Parkinson's Disease. Hope through research. *PHS Publication No. 811 (Health Information Series No. 100); 15 pages; 15 cents, \$11.25 per 100.* Case reports describe symptoms, diagnoses, and treatment of persons with Parkinson's disease. Brief discussions of the work of epidemiologists, research scientists, and physicians indicate various exploratory approaches to the search for the cause and control or prevention of the disease.

Patients in Mental Institutions, 1959. Part II. Public hospitals for the mentally ill. *PHS Publication No. 820; 1961; 72 pages.*

Basic data are presented on numbers and characteristics of hospitalized mental patients, movement of patient population, and administration.

Research Grants in Environmental Health. *PHS Publication No. 870; 1961; 24 pages.*

This pamphlet describes needed research areas and topics in the fields of air pollution, environmental engineering and food protection, occupational health, radiological health, and water supply and pollution control, and lists other types of grant awards (traineeships and institutional). Specific divisional offices from which additional information can be obtained are named.

Veterans with Mental Disorders Resident in Veterans Administration Hospitals. *PHS Publication No. 868; 1961; 43 pages.*

Data, previously unpublished, on numbers and characteristics of men-

tal health patients in Veterans Administration hospitals is provided. A 20 percent systematic random sample was used to represent the characteristics of psychiatric patients in VA facilities as of November 30, 1959. The survey covered patients in psychiatric facilities and general medical and surgical hospitals.

This publication is distributed free upon request to the Biometrics Branch, National Institute of Mental Health, National Institutes of Health, Bethesda 14, Md.

Project Grants to Develop and Demonstrate Better Methods of Providing Community Health Services for the Chronically Ill and Aged. *PHS Publication No. 881; 1961; leaflet.*

Project grants recently authorized under the Community Health Services Act of 1961 are described. The grants are designed to support studies, demonstrations, and experiments leading to new and improved community health services outside the hospital, with particular emphasis on services needed by the chronically ill and aged.

Public and nonprofit private agencies and organizations may apply for the grants, and information is given on the kind of assistance available, the types of projects eligible, and how application may be made.

This section carries announcements of new publications prepared by the Public Health Service and of selected publications prepared with Federal support.

Unless otherwise indicated, publications for which prices are quoted are for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Orders should be accompanied by cash, check, or money order and should fully identify the publication. Public Health Service publications which do not carry price quotations, as well as single sample copies of those for which prices are shown, can be obtained without charge from the Public Inquiries Branch, Office of Information, Public Health Service, Washington 25, D.C.

The Public Health Service does not supply publications other than its own.
